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(54) ENDARTERECTOMY SURGICAL INSTRUMENTS

CHIRURGISCHE INSTRUMENTE ZUR ARTERIENINNENHAUTENTFERNUNG

INSTRUMENTS CHIRURGICAUX POUR ENDARTERIECTOMIE

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Description

TECHNICAL FIELD

[0001] The present invention relates, in general, to surgical instruments and procedures and, in particular, to the cleaning of arteries to remove plaque build-ups.

BACKGROUND OF THE INVENTION

[0002] It has been common practice to open the full selected length of an artery which is to be cleaned of plaque build-ups and tediously separate the inner layers (i.e. the "core") from the outer layers to remove the plaque build-ups along the length of the artery after which the full length of the opening is sutured closed using the outer layers for the closure. Because such incisions, for example, can extend along the entire length of the leg from the groin to the foot, such a procedure is a massive surgical invasion. As the length of the incision increases, the difficulty of the surgical procedure increases.

[0003] Another procedure, involving relatively small incisions at the ends of the artery section to be cleaned, also has been performed in the past for the removal of plaque build-ups. In this procedure, plaque build-ups are removed or loosened by forceps which are introduced at the two incisions to "core out" the artery. To remove residue plaque, a "stripper" (e.g. a catheter-type unit) is passed through the entire blocked artery from the upper incision to the lower incision and a certain, limited amount of residue plaque is pushed out through the lower incision. A swab is secured to the leading end of the catheter-type unit after it has emerged through the lower incision. Upon retraction of the catheter-type unit, the swab carries residue plaque toward and out from the upper incision. Thereafter, the two incisions are closed. Because this procedure is "blind" in that the artery section being cleaned is not open and exposed, it is inherently dangerous. Also, the second incision is necessary either for an exit of plaque or to gain access to the catheter-type unit for affixing the swab.

[0004] In another technique for the removal of plaque build-ups, known as gas endarterectomy, a jet of carbon dioxide gas is injected into the wall of an artery to create a "separation plane." A small opening is made in the artery and a special gas spatula, carefully designed not to injure the artery, is passed down the separation plane as carbon dioxide gas passes through the spatula further freeing up the entire length of the inner core. The inner core then is removed by transecting the distal end and pulling the entire core out of the proximal opening in the artery after which the two openings are closed. Because this procedure also is "blind" in that the artery section being cleaned is not open and exposed, it is inherently dangerous. Also, this procedure requires at least two surgical incisions to expose both ends of the artery section to be cleaned and two openings in the artery itself. An example for a "blind" endarteroctomy spatula is shown in US-A 3,525,339.

[0005] Gas endarterectomy also has been carried out by first surgically opening the body part, but not the artery which is to be cleaned, along the full selected length of the artery and then performing the gas endarterectomy by viewing the probing of the artery through the sufficiently transparent artery wall. Such a procedure also is a massive surgical invasion. As the length of the incision increases, the difficulty of the surgical procedure increases.

[0006] Because of the difficulties and hazards associated with the surgical procedures described above, bypass surgical procedures became popular. Instead of cleaning out a plaque build-up in an artery, the section of the artery having the plaque build-up is bypassed surgically. Such a bypass procedure also is a massive surgical invasion. As the length of the bypass increases, the difficulty of the surgical procedure increases.

[0007] At the present time, there is a trend for reducing the degree of invasion in surgical procedures. Consequently, more and more renewed interest is being expressed in gas endarterectomy which reduces surgical invasion and the period of time the patient must remain in the hospital.

SUMMARY OF THE INVENTION

[0008] The present invention is defined in the independent claim. Advantageous embodiments are defined by the subclaims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Figure 1 is a top view, partially in cross-section, of an endarterectomy surgical instrument constructed in accordance with the present invention.

Figure 2 is an end view of the spatula tip portion of the endarterectomy surgical instrument of Figure 1.

Figure 3 is a sectional view of the optics portion of the endarterectomy surgical instrument of Figure 1.

Figure 4 is a sectional view of a human artery partially filled with plaque build-ups.

Figure 5 is an end view of a second embodiment of the spatula tip portion of the endarterectomy surgical instrument of Figure 1.

Figure 6 is a sectional view of a portion of a third embodiment an endarterectomy surgical instrument constructed in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0010] Referring to Figures 1, 2 and 3, an endarterectomy surgical instrument, constructed in accordance with the present invention, includes a spatula tip **10** having at a first end thereof an optics (i.e. light and image) opening **12** and a plurality of fluid openings **14**. As will be explained below, optics opening **12** permits a light from a light source to be conducted to a surgical site and an image of the surgical site to be conducted to an image forming unit. In this way, the surgeon can observe the surgical procedure being conducted within the artery without the need to open the entire length of the artery which is being cleaned. As will also be explained below, fluid openings **14** permit the passage of a fluid, typically carbon dioxide, to the surgical site to increase the space (i.e. the "separation plane") between the adventitia layer and the media layer of the artery. In this way, spatula tip **10** can be advanced along the length of the artery which is being cleaned. Spatula tip **10** preferably has a curved body which approximates the shape of an artery and is sized for the particular artery being cleaned.

[0011] Preferably, spatula tip **10** also has at the first end thereof a plurality of liquid openings **16a** and **16b** to permit the passage of a liquid to and from the surgical site to carry away plaque debris and clean optics opening **12.** The liquid is conducted to the surgical site through liquid opening **16a** and is conducted away from the surgical site through liquid opening **16b.** Typically, the liquid can be a saline solution.

[0012] An endarterectomy surgical instrument, constructed in accordance with the present invention, also includes first flexible tubular means **18** extending through spatula tip 10 from optics opening **12** in the spatula tip for conducting a light from a remote end of the first flexible tubular means through the optics opening to a surgical site and an image of the surgical site through the optics opening to the remote end of the first flexible tubular means. Such first flexible tubular means **18** can include first fiber optic means through which light is conducted to the surgical site and second fiber optic means through which an image of the surgical site is conducted. For the embodiment of the invention shown in Figure 3, the first fiber optic means include a plurality of fiber optic cables **20** disposed in a circular array and the second fiber optic means include a single fiber optic cable **22** disposed at the center of the circular array of the plurality of fiber optic cables **20** of the first fiber optic means. As shown in Figures 1 and 2, optics opening **12** and fiber optic cables **20** and **22** preferably are within the curved body of spatula tip **10** rather than outside the inner and outer curved surfaces of the spatula tip to facilitate the design and minimize the size of the spatula tip.

[0013] An endarterectomy surgical instrument, constructed in accordance with the present invention, further includes second flexible tubular means **24** extending through **10** spatula tip from fluid openings **14** in the spatula tip for conducting a fluid from a remote end of the second flexible tubular means through the fluid openings to the surgical site.

[0014] Although first flexible tubular means **18** and second flexible tubular means **24** are shown as being spaced apart, they can be arranged in a coaxial manner.

[0015] When a liquid is to be delivered to the surgical site, an endarterectomy surgical instrument, constructed in accordance with present invention, further includes third flexible tubular means **26** extending through spatula tip **10** from liquid openings **16a** and **16b** in the spatula tip for conducting liquid from a remote end of the third flexible tubular means to the surgical site through a first of the liquid openings and for conducting liquid through a second of the liquid openings from the surgical site to the remote end of the third flexible tubular means.

[0016] An endarterectomy surgical instrument, constructed in accordance with present invention, also includes connector means **28** adapted for connection to a light source, an image forming unit, and a fluid source and to which the remote end of first flexible tubular means **18** and the remote end of second flexible tubular means **24** are connected. When liquid is to delivered to and drawn from the surgical site, connector means **28** are adapted for connection to a liquid source and a liquid discharge reservoir and the remote end of third flexible tubular means **26** are connected to the connector means. In this way, light from the light source is conducted to first flexible tubular means **18**, an image of the surgical site is conducted from first flexible tubular means **18** to the image forming unit, fluid from the fluid source is conducted to second flexible tubular means **24,** and liquid is to delivered from the liquid source to third flexible tubular means **26** and delivered from the third flexible tubular means to the liquid discharge reservoir.

[0017] Connector means **28** can include conventional luer lock connectors to which the fluid source and second flexible tubular means **24** are connected for the passage of fluid and to which the liquid source, liquid discharge reservoir and third flexible tubular means **26** are connected for the passage of saline solution. In contrast, the first fiber optic means through which light is conducted to the surgical site and the second fiber optic means through which the image of the surgical site is conducted to the image forming unit are continuous, uninterrupted fiber optic cables which pass through connector means **28** but are locked by the connector means against longitudinal and rotational sliding and sealed to prevent escape of carbon dioxide gas and saline solution.

[0018] Preferably, an endarterectomy surgical instrument, constructed in accordance with the present invention, includes a flexible sheathing **30** extending between spatula tip **10** and connector means **28** and through which first flexible tubular means **18**, second flexible tubular means **24** and third flexible tubular means **26** extend. Flexible sheathing **30** can be a tubular piece, as shown in Figure 1, through which separately formed first tubular means **18**, second tubular means **24** and third

flexible tubular means **26** extend or the sheathing and the tubular means can be formed as a single, flexible extruded piece with passages or channels through which the light, the image of the surgical site, the fluid and the saline solution are conducted.

[0019] The surgical instrument just described can be used in an endarterectomy surgical procedure for removing a plaque build-up from a selected length of an artery in accordance with the present invention. First, an incision is made and the artery is dissected at a first end of a selected length of the artery from which a plaque build-up is to be removed. Next, the outer wall of the artery is penetrated with a needle, typically 25 gauge, and carbon dioxide gas is introduced through the needle to start the separation of the adventitia layer and the media layer (i.e. the "separation plane"). The needle is removed and an incision is made into the artery wall.

[0020] Referring to Figure 4, the next step in the endarterectomy surgical procedure, performed in accordance with the present invention, is inserting a spatula **10** into the artery at the incision between the adventitia layer **40** and the media layer **42** of the artery. Next, the selected length of the artery is probed with the spatula while applying a fluid (e.g. carbon dioxide gas) under a controlled pressure through the spatula tip to increase the space between the adventitia layer **40** and the media layer **42** of the artery. The carbon dioxide gas also reduces the amount of blood at the surgical site. The carbon dioxide gas is either absorbed or flows out through the incision in the artery wall. Saline solution, under a controlled pressure, can be delivered to the surgical site to flush away pieces of plaque which have broken away from the plaque build-up **44** and to clean the optics opening in the spatula tip. It is important to control the pressures of the carbon dioxide gas and saline solution to eliminate the potential for creating damage to the artery when there is a total blockage of the artery by the plaque build-up.

[0021] As the artery is being probed, an image of the surgical site at the spatula is continuously developed, so that the surgeon performing the procedure can view the image of the surgical site while probing the artery. Side branches of the artery are isolated as the artery is probed. Probing of the artery is terminated at a second end of the selected length of the artery and the spatula is retracted and removed from the artery through the incision.

[0022] Next, the plaque build-up **44**, along with the intima layer **46** and the media layer **42.** of the artery (i.e. the "core"), are removed from the artery. The core can be removed by pulling the plaque build-up out through the incision with forceps if the plaque has been broken or weakened at the second end of the selected length of the artery. This can be determined by viewing the image of the surgical site as the spatula is moved along the artery.

[0023] If necessary, after the spatula has been retracted and removed from the artery a surgical instrument, such as the ones illustrated in Figures 7A, 7B, 7C and 8, can be inserted into the artery through the incision and advanced to the second end of the selected length of the artery at which the plaque build-up is cut. When the surgical cutting instrument is retracted and removed from the artery, the plaque build-up is pulled out through the incision by the surgical cutting instrument or with forceps.

[0024] After the plaque build-up has been removed, the termination transition at the second end of the selected length of the artery is treated and the incision is closed. If the spatula is arranged with liquid openings, liquid can be delivered to the surgical site and drawn away from the surgical site while the artery is being probed. It is important to remove plaque debris from the artery before the incision is closed.

[0025] It is important to prepare the termination transition or there can be further stripping of plaque by blood flow. There is also the potential for clotting and debris at the termination if the transition is abrupt. The termination transition can be prepared by a laser instrument which can be included in an endarterectomy surgical instrument constructed in accordance with the present invention. As shown in Figure 5, spatula tip **10** can have a laser opening **32** through which a laser beam can be emitted to prepare the termination transition.

[0026] As shown in Figure 6, an endarterectomy surgical instrument, constructed in accordance with the present invention, can be arranged with a balloon and used in a surgical procedure in the same way that a balloon catheter is used. The flexible sheathing **34** has a balloon **36** bonded to the outside surface of the sheathing. With balloon **36** deflated, it lies flat against the outside surface of flexible sheathing **34**. When a fluid, under controlled pressure, is introduced into balloon **36** through air passage **38**, the balloon inflates as shown in Figure 6.

[0027] While in the foregoing there have been described preferred embodiments of the present invention, it should be understood by those skilled in the art that various modifications and changes can be made without departing from the scope of the present invention.

Claims

1. An endarterectomy surgical instrument comprising:

a spatula tip (10) having at a first end thereof:

(a) an optics opening (12), and
(b) a plurality of fluid openings (14);

first flexible tubular means (18) extending through said spatula tip (10) from said optics opening (12) in said spatula tip (10) for conducting:

(a) a light from a light source at a remote end of said first flexible tubular means (18) through said optics (12) opening to a surgical site, and
(b) an image of the surgical site through said optics (12) opening to said remote end of said first flexible tubular means (18);

second flexible tubular means (24) extending through said spatula tip (10) from said fluid openings (14) in said spatula tip (10) for conducting a fluid from a remote end of said second flexible tubular means (24) through said fluid openings (14) to the surgical site; and
connector means (28) adapted for connection to:

(a) a light source,
(b) an image forming unit, and
(c) a fluid source

and to which:

(a) said remote end of said first flexible tubular means (18), and
(b) said remote end of said second flexible tubular means (24) are

connected for conducting:

(a) the light from the light source to said first flexible tubular means (18),
(b) the image of the surgical site from said first flexible tubular means (18) to the image forming unit, and
(c) fluid from the fluid source to said second flexible tubular means (24).

2. An endarterectomy surgical instrument according to claim 1 further including a flexible sheathing (30) extending between said spatula tip (10) and said connector means (28) and through which said first flexible tubular means (18) and said second flexible tubular means (24) extend.

3. An endarterectomy surgical instrument according to claim 2 wherein said first flexible tubular means (18) include:

(a) first fiber optic means through which the light is conducted, and
(b) second fiber optic means through which the image of the surgical site is conducted.

4. An endarterectomy surgical instrument according to claim 3 wherein:

(a) said first fiber optic means include a plurality of fiber optic cables (20) disposed in a circular array, and
(b) said second fiber optic means include a single fiber optic cable (22) disposed at the center of said circular array of said plurality of fiber optic cables (20) of said first fiber optic means.

5. An endarterectomy surgical instrument according to claim 4 wherein said spatula tip (10) has a curved body and said optics opening (12), said plurality of fiber optic cables (20) and said single fiber optic cable (22) are within said curved body of said spatula tip (10).

6. An endarterectomy, surgical instrument according to claim 2 wherein:

(a) said spatula tip (10) also has at said first end thereof a plurality of liquid openings (14),
(b) said connector means (28) also are adapted for connection to a liquid source and a liquid discharge reservoir, and
(c) said endarterectomy surgical instrument further includes third flexible tubular means (26) extending through said spatula tip (10) from said liquid openings (14) in said spatula tip (10) for conducting liquid from a remote end of said third flexible tubular means (26) connected to said connector means to the surgical site through a first of said liquid openings (16a) and for conducting liquid through a second of said liquid openings (16b) from the surgical site to said remote end of said third flexible tubular means (26).

7. An endarterectomy surgical instrument according to claim 6 wherein said third flexible tubular means (26) extend through said flexible sheathing (30).

8. An endarterectomy surgical instrument according to claim 2 wherein said spatula tip (10) also has at said first end thereof a laser opening (32) through which a laser beam is emitted.

9. An endarterectomy surgical instrument according to claim 2 further including:

(a) a balloon (36) bonded to said sheathing (30), and
(b) a fluid passage (38) through which a fluid, under controlled pressure, is introduced into said balloon (36) to inflate said balloon (36).

Patentansprüche

1. Chirurgisches Endarterektomie-Instrument, umfassend:

eine Spatelspitze (10), deren erstes Ende Folgendes aufweist:

(a) eine Optiköffnung (12) und
(b) eine Mehrzahl von Fluidöffnungen (14);

wobei sich ein erstes flexibles röhrenförmiges Mittel (18) von der Optiköffnung (12) in der Spatelspitze (10) durch die Spatelspitze (10) erstreckt, um

(a) Licht von einer Lichtquelle an einem entfernten Ende des ersten flexiblen röhrenförmigen Mittels (18) durch die Optiköffnung (12) zu einer Operationsstelle und
(b) ein Bild der Operationsstelle durch die Optiköffnung (12) zum entfernten Ende des ersten flexiblen röhrenförmigen Mittels (18) zu leiten;

wobei sich ein zweites flexibles röhrenförmiges Mittel (24) von den Fluidöffnungen (14) in der Spatelspitze (10) durch die Spatelspitze (10) erstreckt, um ein Fluid von einem entfernten Ende des zweiten flexiblen röhrenförmigen Mittels (24) durch die Fluidöffnungen (14) zur Operationsstelle zu leiten; und

eine Verbindungseinrichtung (28), die zur Verbindung mit:

(a) einer Lichtquelle,
(b) einer bilderzeugenden Einheit und
(c) einer Fluidquelle

angepasst ist und an der

(a) das entfernte Ende des ersten flexiblen röhrenförmigen Mittels (18) und
(b) das entfernte Ende des zweiten flexiblen röhrenförmigen Mittels (24) angeschlossen sind, um

(a) das Licht von der Lichtquelle zum ersten flexiblen röhrenförmigen Mittel (18),
(b) das Bild der Operationsstelle vom ersten flexiblen röhrenförmigen Mittel (18) zur bilderzeugenden Einheit und
(c) Fluid von der Fluidquelle zum zweiten flexiblen röhrenförmigen Mittel (24) zu leiten.

2. Chirurgisches Endarterektomie-Instrument gemäß Anspruch 1, weiters umfassend eine flexible Ummantelung (30), die sich zwischen der Spatelspitze (10) und der Verbindungseinrichtung (28) erstreckt und durch die sich das erste flexible röhrenförmige Mittel (18) und das zweite flexible röhrenförmige Mittel (24) erstrecken.

3. Chirurgisches Endarterektomie-Instrument gemäß Anspruch 2, wobei das erste flexible röhrenförmige Mittel (18) Folgendes umfasst:

(a) erste faseroptische Mittel, durch die das Licht geleitet wird, und
(b) zweite faseroptische Mittel, durch die das Bild der Operationsstelle geleitet wird.

4. Chirurgisches Endarterektomie-Instrument gemäß Anspruch 3, wobei:

(a) die ersten faseroptischen Mittel eine Mehrzahl von Glasfaserkabeln (20) umfassen, die in einer kreisförmigen Gruppierung angeordnet sind, und
(b) die zweiten faseroptischen Mittel ein einzelnes Glasfaserkabel (22) umfassen, das in der Mitte der kreisförmigen Gruppierung der Mehrzahl von Glasfaserkabeln (20) der ersten faseroptischen Mittel angeordnet ist.

5. Chirurgisches Endarterektomie-Instrument gemäß Anspruch 4, wobei die Spatelspitze (10) einen gekrümmten Körper aufweist und die Optiköffnung (12), die Mehrzahl von Glasfaserkabeln (20) und das einzelne Glasfaserkabel (22) im gekrümmten Körper der Spatelspitze (10) liegen.

6. Chirurgisches Endarterektomie-Instrument gemäß Anspruch 2, wobei:

(a) die Spatelspitze (10) an ihrem ersten Ende auch eine Mehrzahl von Flüssigkeitsöffnungen (14) aufweist,
(b) die Verbindungseinrichtung (28) auch zum Anschließen an einer Flüssigkeitsquelle und einem Flüssigkeitsableitungsbehälter angepasst ist, und
(c) das chirurgische Endarterektomie-Instrument weiters ein drittes flexibles röhrenförmiges Mittel (26) umfasst, das sich von den Flüssigkeitsöffnungen (14) in der Spatelspitze (10) durch die Spatelspitze (10) erstreckt, um von einem entfernten Ende des dritten, an der Verbindungseinrichtung angeschlossenen, flexiblen röhrenförmigen Mittels (26) durch eine erste Flüssigkeitsöffnung (16a) Flüssigkeit zur Operationsstelle zu leiten und um durch eine zweite Flüssigkeitsöffnung (16b) Flüssigkeit von der Operationsstelle zum entfernten Ende des dritten flexiblen röhrenförmigen Mittels (26) zu leiten.

7. Chirurgisches Endarterektomie-Instrument gemäß Anspruch 6, wobei sich das dritte flexible röhrenförmige Mittel (26) durch die flexible Ummantelung (30) erstreckt.

8. Chirurgisches Endarterektomie-Instrument gemäß

Anspruch 2, wobei die Spatelspitze (10) an ihrem ersten Ende auch eine Laseröffnung (32) aufweist, durch die ein Laserstrahl ausgesandt wird.

9. Chirurgisches Endarterektomie-Instrument gemäß Anspruch 2, weiters umfassend:

(a) einen an die Ummantelung (30) gebundenen Ballon (36), und
(b) einen Fluidkanal (38), durch den unter kontrolliertem Druck ein Fluid in den Ballon (36) eingebracht wird, um den Ballon (36) aufzublasen.

Revendications

1. Instrument chirurgical d'endartériectomie comprenant :

une pointe de spatule (10) présentant à une première extrémité de celle-ci :

(a) une ouverture optique (12), et
(b) une pluralité d'ouvertures de fluide (14) ;

des premiers moyens tubulaires flexibles (18) s'étendant à travers la pointe de spatule (10) depuis ladite ouverture optique (12) dans ladite pointe de spatule (10) pour conduire :

(a) une lumière provenant d'une source lumineuse à une extrémité éloignée desdits premiers moyens tubulaires flexibles (18) à travers ladite ouverture optique (12) vers un site opératoire, et
(b) une image du site opératoire à travers ladite ouverture optique (12) vers ladite extrémité éloignée desdits premiers moyens tubulaires flexibles (18) ;

des deuxièmes moyens tubulaires flexibles (24) s'étendant à travers ladite pointe de spatule (10) desdites ouvertures de fluide (14) dans ladite pointe de spatule (10) pour conduire un fluide d'une extrémité éloignée desdits deuxièmes moyens tubulaires flexibles (24) à travers lesdites ouvertures de fluide (14) vers le site opératoire ; et
des moyens formant connecteur (28) adaptés pour la connexion à :

(a) une source lumineuse,
(b) une unité de formation d'image, et
(c) une source fluide

et auxquelles :

(a) ladite extrémité éloignée desdits premiers moyens tubulaires flexibles (18) et
(b) ladite extrémité éloignée desdits deuxièmes moyens tubulaires flexibles (24) sont connectées pour conduire :

(a) la lumière provenant de la source lumineuse vers lesdits premiers moyens tubulaires flexibles (18),
(b) l'image du site opératoire depuis lesdits premiers moyens tubulaires flexibles (18) vers l'unité de formation d'image, et
(c) le fluide provenant de la source fluide vers lesdits deuxièmes moyens tubulaires flexibles (24).

2. Instrument chirurgical d'endartériectomie selon la revendication 1, comprenant en outre une gaine flexible (30) s'étendant entre ladite pointe de spatule (10) et lesdits moyens formant connecteur (28) et à travers laquelle s'étendent lesdits premiers moyens tubulaires flexibles (18) et lesdits deuxièmes moyens tubulaires flexibles (24).

3. Instrument chirurgical d'endartériectomie selon la revendication 2, dans lequel lesdits premiers moyens tubulaires flexibles (18) comprennent :

(a) des premiers moyens de fibre optique à travers lesquels la lumière est conduite, et
(b) des seconds moyens de fibre optique à travers lesquels l'image du site opératoire est conduite.

4. Instrument chirurgical d'endartériectomie selon la revendication 3, dans lequel :

(a) lesdits premiers moyens de fibre optique comprennent une pluralité de câbles à fibre optique (20) disposés dans un arrangement circulaire, et
(b) lesdits seconds moyens de fibre optique comprennent un unique câble à fibre optique (22) disposé au centre dudit arrangement circulaire de ladite pluralité de câbles à fibre optique (20) desdits premiers moyens de fibre optique.

5. Instrument chirurgical d'endartériectomie selon la revendication 4, dans lequel ladite pointe de spatule (10) présente un corps incurvé et ladite ouverture optique (12), ladite pluralité de câbles à fibre optique (20) et ledit unique câble à fibre optique (22) sont à l'intérieur dudit corps incurvé de ladite pointe de spatule (10).

6. Instrument chirurgical d'endartériectomie selon la revendication 2, dans lequel :

(a) ladite pointe de spatule (10) présente également à la première extrémité de celle-ci une pluralité d'ouvertures de fluide (14),
(b) lesdits moyens formant connecteur (28) sont également adaptés pour la connexion à une source fluide et à un réservoir d'évacuation des fluides, et
(c) ledit instrument chirurgical d'endartériectomie comprend en outre des troisièmes moyens tubulaires flexibles (26) s'étendant à travers ladite pointe de spatule (10) depuis lesdites ouvertures de fluide (14) dans ladite pointe de spatule (10) pour conduire le fluide depuis une extrémité éloignée desdits troisièmes moyens tubulaires flexibles (26) connectés auxdits moyens formant connecteur vers le site opératoire à travers une première desdites ouvertures de fluide (16a) et pour conduire le fluide à travers une seconde desdites ouvertures de fluide (16b) depuis le site opératoire vers ladite extrémité éloignée desdits troisièmes moyens tubulaires flexibles (26).

7. Instrument chirurgical d'endartériectomie selon la revendication 6, dans lequel lesdits troisièmes moyens tubulaires flexibles (26) s'étendent à travers ladite gaine flexible (30).

8. Instrument chirurgical d'endartériectomie selon la revendication 2, dans lequel ladite pointe de spatule (10) présente également à ladite première extrémité de celle-ci une ouverture laser (32) à travers laquelle un faisceau laser est émis.

9. Instrument chirurgical d'endartériectomie selon la revendication 2 comprenant en outre :

(a) un ballonnet (36) relié à ladite gaine (30), et
(b) un passage de fluide (38) à travers lequel un fluide, sous pression contrôlée, est introduit dans ledit ballonnet (36) pour gonfler ledit ballonnet (36).

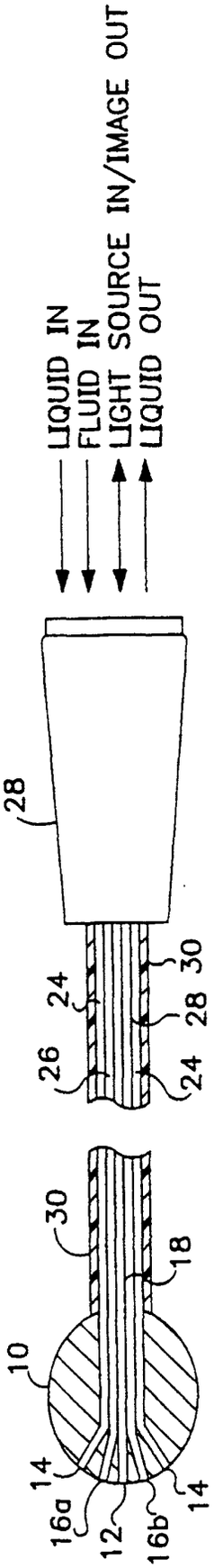

FIG. 1

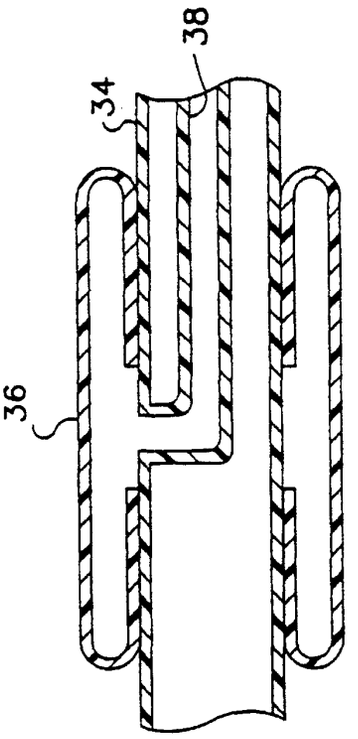

FIG. 6

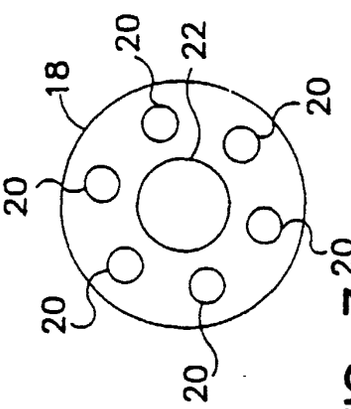

FIG. 3

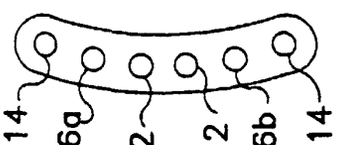

FIG. 5

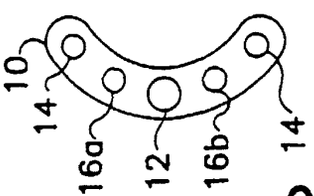

FIG. 2

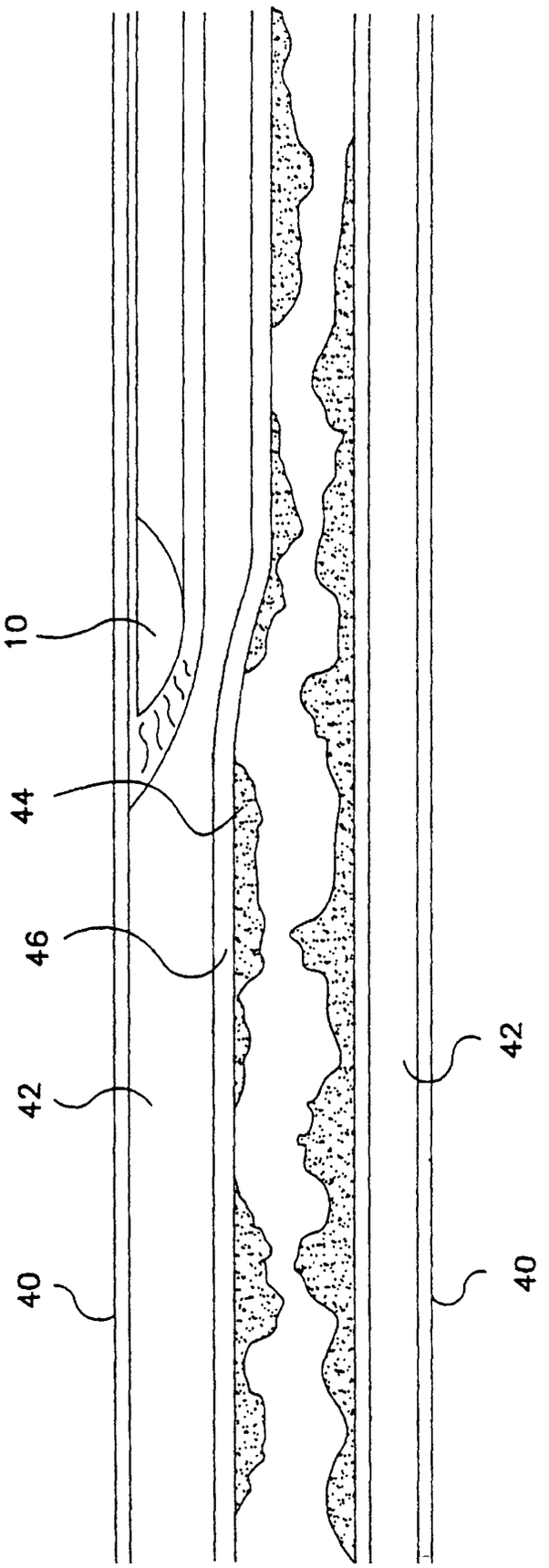

FIG. 4